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Electronic funds transfer as a subject of study in technology, society and public policy

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As society becomes increasingly dependent upon technology, and so increasingly a subject of public policy scrutiny, it is essential to acquire as much knowledge as possible about technology development, adoption, use, and impacts. The authors propose in detail a long-term study of electronic funds transfer that would cover six major topics: how technology emerges; how new technology is handled by existing institutions; how new technologies are assimilated by the public; what specific impacts new technologies have; how new technologies create synergistic impacts with other technologies; and how technologies change over time to conform to new circumstances and developments. They conclude with a consideration of the measures necessary for the implementation of such a study.

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The idea of studying a particular technological innovation and following it through development, deployment, and eventual widespread use is not new. The value of taking technology seriously as a force in the modern world has been obvious to 'progressive' members of society for many years, and attempts by individuals and groups to establish the study of modern technology as an ongoing effort date back to before the second world war.[1] However, popular interest in anticipating the impacts likely to come from technology remained for many years in the realm of speculative fiction, particularly in the creation of technological utopias and anti-utopias that have been produced over the past century and a half.[2] Until very recently, there was little interest in taking specific technological developments and seriously exploring their likely short-term and long-term impacts on society with a mind towards public policy. Technology, at least in the USA, has held an esteemed status as the great tool by which the country became the premier industrial power, and it is still frequently asserted that only through technology will the US position be maintained. Technological progress, by and large, has been something to anticipate with excitement.

During the past three decades, however, the popular and positive attitude towards technology has started to wane. The exact period at which this shift in social attitude began is difficult to determine, but widespread public questioning of technology's beneficence appears to have begun when the brutal realities of the possible destruction from atomic power became apparent.[3] Many new technologies have followed in close succession since atomic power came on line.[4] Equally important, many new technological developments have been linked to existing technologies to produce qualitatively new technological 'packages' that in themselves represent breakthroughs.[5]

Widespread social realization of the public policy importance of technology has lagged behind technological development in the past, but is rapidly catching up. Once the systematic effects of some existing technologies became understood in greater detail (the

[1] Two interesting quotations are relevant here, one from 1936, the other from 1937. The first is from President

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Roosevelt's open letter to Dr Karl Compton, then president of the Massachusetts Institute of Technology: 'The design and construction of specific civil engineering works or of instruments of production represent only one part of the responsibility of engineering. It must also consider social pressures and problems, and modes of more perfect adjustment to environment, and must cooperate in designing accommodating mechanisms to absorb the shocks of the impacts of science.' (From 'The responsibility of engineering', a letter from Franklin Roosevelt appearing in *Science*, Vol 84, 30 October 1936, pp 393–394.) The second is taken from a section of a Report of the Subcommittee on Technology to the National Resources Committee: 'So closely interrelated is the mechanism of modern civilization that a change occurring in one part, say in industry, will produce an effect in quite a different and unexpected part, as for instance in the schools, or the use of natural resources. Hence we need a view of the general causes, types, and trends over a broad front, since any specific program may be affected by the forces originating elsewhere ... It is clearly seen, then, that scientific discoveries in applied science and invention do have important social consequences that greatly affect public policies ... it is commonly said that a greater part of all social changes of modern times are precipitated by technological change.' (*Technological Trends and National Policy, Including the Social Implications of New Inventions*, Subcommittee on Technology, National Resources Council, Washington, DC, June 1937.)

[2] For example, with date of first publication in brackets, Mary Shelley, *Frankenstein, or the Modern Prometheus*, (1831), Bobbs Merrill, New York, 1974; H.G. Wells, *The Time Machine*, (1895), Abbey Press, Cambridge, Mass, 1931; E.M. Forster, *The Machine Stops*, (1909), in *Of Man and Machines*, ed Arthur O. Lewis, E.P. Dutton, New York, 1963; Yevgeny Zamyatin, *We*, (1920), Viking Press, New York, 1972; and Aldous Huxley, *Brave New World*, (1939), Harper Press, New York, 1939. Many more could be added to the list, especially works published after 1940. Modern science fiction is generally inspired by the basic question of what technology will do to man, or *vice versa*.

[3] A rather penetrating and provocative comment on the atomic bomb appeared in the official report of the development of the bomb in 1945, which concluded 'Here is a new tool for mankind, a tool of almost unimaginable destructive power. Its development raises many questions that must be answered in the near future ... These questions are not technical; they are political and social questions, and the answers given to them

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automobile's role in smog, for example) more and more people could see that new technologies could have negative as well as positive effects on their personal lives.[6]

People are increasingly aware that they are surrounded by technology on which they depend for the maintenance of their lifestyle, yet which they do not really understand. This condition of ignorant dependence has taken its toll in public confidence in large-scale, pervasive technology. While major but short-lived technological problems such as the 1965 Northeast power blackout can be brushed aside with amusing anecdotes, and even made into film comedy,[7] it does not take people long to speculate about how bad a real blackout of extended duration would be. Add to the fear of nuclear war and the power blackout the remainder of the list of diverse technology-driven concerns[8] and the net result is a growing public wariness of new, and even existing technologies.

In the USA this wariness has found its tools in the form of public policy decisions in government. Technology has become a 'thing in itself' in the government, having been granted a continuing bureaucratic presence in both the Congress and Executive branches of the federal government, in state governments, and even in local governments.[9] Admittedly, many of these governmental activities in technology are aimed at development, promotion, and transfer of technology, but increasingly governmental entities are making public policy about technology, and they are doing so at the urging of an interested and concerned populace.[10] This public policy thrust in government is a comparatively new phenomenon, and certainly not all technological developments fall under public policy consideration.[11] Nevertheless, large-scale, expensive, and potentially hazardous technological enterprises are increasingly thrown into a political debate unparallelled in history.

The political milieu in which such technological development (or failure) takes place is frequently overlooked in the attempt to understand the role technology plays in society, yet it is politics, involving coalitions of varied interests, that lies at the heart of technological progress these days. Those technologies that survive do so because they have both applicability and a social sanction to continue. That social sanction, once a *de facto* condition of invention and innovation, now appears to be revocable. 'Public policy' made about the SST in 1961 bears little resemblance to public policy on the SST in 1977, and the same story can be told about saccharin, citizen band radios, auto emission controls, and many other items. The point is that there is no such thing as a public policy about technology, and the pressure to evaluate and re-evaluate policies about technologies increases as more diverse interests bring their opinions to bear on legislators, executives, and the judiciary. The controversies that have appeared over the past ten years are only the beginning.

Public policy and continuing policy research

Major public policy issues in the USA are almost invariably the subject of at least one commissioned study. It seems an automatic response to a complex dilemma of values and interests to commission a fact-finding study. In keeping with this characteristic of American life, we propose that a study be commissioned for electronic funds transfer (EFT).[12] However, this study will be rather different from the

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may affect all mankind for generations.' (See H.D. Smythe, *Atomic Energy for Military Purposes: The Official Report of the Development of the Atomic Bomb under the Auspices of the United States Government, 1940-1945*, Princeton, NJ, 1945).

[4] Guided rocketry, television, jet aircraft, digital computers, advances in electronics and materials technology, to name just a few.

[5] For example, the marriage of nuclear fission and guided rocketry, both great advances in physics and engineering, produced the nuclear ICBM which was a breakthrough in weapons technology.

[6] It is worthwhile to note that this concern has prompted substantial literature with 'technology out of control' as a theme. This concept of autonomous technology has adherents that range from the most radical (who envisage man either being enslaved or destroyed by technology) to the more moderate who merely assert that effort must be made to bring technology back into check. See, for example, Henry Adams, *The Education of Henry Adams*, The Modern Library, New York, 1931; Jaques Ellul, *The Technological Society*, Alfred A. Knopf, New York, 1971; David Landes, *The Unbound Prometheus: Technological Change and Industrial Development in Western Europe from 1970 to the Present*, Cambridge University Press, Cambridge, UK, 1969; Herman Marcuse, *One Dimensional Man: Studies in the Ideology of Advanced Industrial Society*, Beacon Press, Boston, 1974; Lewis Mumford, *The Myth of the Machine: Technics and Human Development*, Harcourt, Brace and World, New York, 1967; and Lewis Mumford, *The Myth of the Machine: The Pentagon of Power*, Harcourt, Brace, Jovanich, New York, 1970. Others believe that technology has been and continues to be under man's control through his political institutions. See, for example, David Apter, *The Politics of Modernization*, University of Chicago Press, Chicago, 1965; and W. Rostow, *Politics and Stages of Growth*, Cambridge University Press, New York, 1971. An excellent discussion of the whole subject of autonomous v non-autonomous technology concepts can be found in Langdon Winner's recent book, *Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought*, MIT Press, Cambridge, Mass, 1977.

[7] *Where Were You When the Lights Went Out?*, an Everett Freeman, Metro-Goldwyn-Mayer film starring Robert Morse, Patrick O'Neal, and Doris Day, 1968.

[8] Nuclear power electricity generation, thalidomide, chlorofluorocarbon aerosols, chlorinated hydrocarbon pesticides, the SST, the ABM, the Alaska Pipeline, liquified natural gas shipment,

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customary fact-finding, policy-advising study normally commissioned in cases like the EFT debate. Fact-finding study, an important first step in the policy formation process, has already found its form in the National Commission on Electronic Funds Transfer (NCEFT).[13] We do not propose a duplication of that effort for two reasons. First, the *ad hoc* advisory study can really only answer short-term policy questions. The fundamental goal of a fact-finding commission such as the NCEFT is to determine 'what ought to be done' in the short term. There is a need for information to support the continuing stream of public policy questions arising out of EFT after the NCEFT is disbanded. The experience with past public policy processes in issues of technology has shown, as mentioned above, that change is the rule in such policy. Any action taken on EFT in 1977-78 is quite likely to be altered by 1985 for the simple reason that policies made today are frequently inadequate for the needs of tomorrow. Yet the need for information in the EFT policy making process increases as experience with EFT is acquired. Public policy on EFT made before the fact is necessarily restricted to the limited accounts of present experience and speculation about the future. As experience with EFT (or at least with the technology necesary to build EFT systems) advances, it will be appropriate to include the results of that experience in future public policy debates.

The second reason for study beyond the fact-finding efforts of the first public policy debates is more academic, although ultimately quite practical. By conducting thorough study of the process of technological development, from inception to widespread use or ultimate defeat, much will be learned about how technologies have come to be what they are. This goes far beyond just the mechanics of the technology, and moves into the realm of technology in society, taking on the much larger question of how technologies become a part of our social reality, and with what effects. Americans, as a people, spend a good deal of time and resources studying phenomena that they feel they should know about for their own good – the weather, agriculture, history, engineering, administration, and so on. The ultimate purpose of this study of EFT as an issue in society and public policy is to bring a new understanding of the important force of technological development in forming social character.

Proposed longitudinal study of EFT

We propose that EFT be established as a case for study on a continuing basis, in much the same way that weather and public political opinions are now studied. The value of continued studies lies in their ability to gather information over time that can be used for analysing patterns or systematic relationships in the phenomena studied. The proposed research would be the first example of a longitudinal case study of how a technology is developed, modified, adopted, deployed and used in society. It would differ from other studies of technology in two fundamental ways: it would focus on a technology of sufficient scale to provide insight into almost all the issues concerning technology and society that have been raised in the literature; and it could be initiated very close to the actual beginning of the technology itself, and thus provide a real-time documentary account.[14] In a sense, the proposed study can be likened to the quasi-experimental studies advocated by Campbell and Stanley[15] and

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recombinant DNA research, EFT, and so on.

[9] For example, at the federal level, the Congress has the Office of Technology Assessment, the President has his Science Adviser, and the myriad of federal agencies are riddled with technology-oriented activities. We are aware of specific technology-related activities in ERDA, the FCC, NSF, NASA, EPA, DOD, HUD, HEW, Justice, Commerce, State, DOA, Transportation, and the SEC. There is also, of course, the continuing presence of the National Academy of Sciences and Engineering. In at least one state government, California, there is the Office of Appropriate Technology plus a number of gubernatorial science and technology advisers, and this certainly is parallelled in other states. Even at the local level technology has become big business, with the technology transfer efforts of Public Technology Incorporated and the other technology-agent programmes. Perhaps most indicative of the growth of public policy towards technology is the recent case of city councils (Berkeley, CA and Cambridge, Mass, and others) actually considering city ordinances regulating recombinant DNA research activity within city limits.

[10] We admit that there is no single 'populace' clamouring for public policy with regard to technology. Rather, a growing number of citizen-supported groups are making their presence felt as never before. We include in this category such groups as the Sierra Club. These groups are joining the pro-technology development forces of industry, the universities, and the military that have been in existence for a long time.

[11] For example, home electronics developments, with the exception of television, have been excluded for the mostpart.

[12] We would like to make note of two points about this article. First, although we discuss EFT as a subject for study in technology, society and public policy, we do not necessarily endorse the notion that any particular EFT is needed or would prove useful. In other words, we discuss EFT primarily in the context of what we feel should be considered from a longitudinal study standpoint *if EFT development proceeds*. If EFT were to be dumped tomorrow, we would not advocate building a surrogate EFT to study the issues discussed here. Second, we discuss EFT in a somewhat monolithic way for convenience in this paper, yet we recognize that there are already several EFTs operating in one form or another. Whether there will be *an* EFT operating as a single, multifaceted entity is open to speculation. Our objective here is to discuss a set of issues relevant to the subject of EFT broadly considered, so we take the licence to abbreviate the complexity and diversity of EFT systems.

others, in which changes in the existing methods of doing things are systematically studied to see if the rationales for the change are borne out in fact, and if they are not, what does happen. As technology on a large scale becomes more crucial to the continued smooth running of society, and thereby more subject to public policy scrutiny, it is imperative that we know as much as possible about the process of technological development, adoption, use, and impacts.

The proposed study incorporates a number of investigations into a longitudinal study that would cover six major topics, as listed below. Each represents an aspect of EFT concern that has both academic and policy relevance if carried out on a continuing basis.

How technology emerges

Much of the literature on technological development takes a rational view of the process of invention and innovation. An inventor decides what he will invent, goes about systematically planning the invention, works through all the problems, and eventually achieves the invention. The invention has been anticipated throughout in the context of some desired application. This rational view of the process of technological development has been seriously challenged by some writers, who claim that much of what ends up on the technological shelf is the product of serendipity, of 'created markets', or of political forces.[16] Support for either of these views on the emergence of technology has been limited to tracing the development of different inventions in a historical context, often a long period of time. The proposed study would select EFT as a case of an emerging technology and would begin immediately to construct a running account of the actual processes that build what eventually emerges as 'EFT'. Of course, it would be necessary to reconstruct about five years' work through which EFT has been brought to its present state of development, but this would be relatively easy in comparison to the difficulties faced by other historical studies, since most of the principals involved in early EFT development are still available for interview. Also, much study has already gone into the EFT issue by the NCEFT, interested institutions, and numerous individuals who have been studying on their own. The NCEFT work in particular can provide a very rich base for analysis of developments to date.

The proposed study would be able to document aspects of technological development often lost in the work of historians of technology. Particularly, it would be able to give a full account of the competing technological and organizational approaches for the technology that are not part of the final form the technology takes. Thus, much would be preserved about the work of those who eventually 'lose' in the effort to have their concepts for EFT become the model of the real EFT. More importantly, it would be possible to study first-hand the process by which one set of ideas or approaches wins over another. This should reveal the intricate processes by which modern, complex technologies take shape. In so doing, it should provide a new understanding of how policy makers in the public arena can best exert their influence over those technological developments which they are charged to evaluate and regulate.

Defining and handling of new technology by existing institutions

Once the possibilities of new technology become apparent, institutions with an interest in the technology begin to manoeuvre

themselves and the technology into positions they feel beneficial. The first step in this process is the definition of what the technology really represents. The importance of definition can be seen in the case of television. The federal government, in responding to the perceived need to control the new technology of television broadcasting, gave away over 90% of the airwaves (VHF only at the time) to commercial broadcasting interests. Instead of considering the various roles television might serve, and more importantly, what lasting impacts television under alternative forms of control might have, the federal response was to address only the simple question of what commercial interests would be allowed to reap the harvest yielded by the new technology. This was not a decision by default – there were many who suggested that a more 'public' use of the airwaves be the goal of governmental control. They lost the argument largely on the grounds that the private sector should be free to exploit the territory it had uncovered, as was the case with radio. The definition of the technology, so it seems, was as a new form of 'press' – an extension of the written and printed word. There was no effort to create a new distinction in media between the technologically unrestricted field of printed media and the physically limited media of electronic broadcasting.[17]

The question of definition is crucial to the public policy debate over EFT, and the significance of definition is already coming clear. We characterize five institutional thrusts that provide different definitions of EFT:[18]

- *Payments system approach.* EFT is basically a logical extension of a trend that began long before computers and networks. It is a new iteration in the process of coordinating and systematizing the payments system. This process began with development of bank codes for cheques, moved into magnetic ink coding on cheques, development of bank credit cards, automated recordkeeping, and has recently begun to explore linking automated aspects of financial recordkeeping systems together. Thus, EFT is nothing more than a new wrinkle in an old operation, and it will be developed and assimilated with no more difficulty or problem than the other innovations.
- *Financial systems approach.* EFT does not merely signal a change in the payments system, but in the financial system as a whole. It is not just the movement of money that will be affected, but the entire financial activity of the society. This includes aspects of finance such as credit, float, money supply, and structure of financial institutions.
- *Electronic technologism approach.* EFT is more than just a new wrinkle in the payments or financial system: it is creating a new transaction system due to the introduction of advanced electronic technology. EFT is no more like the existing payments system than the telephone is like mail. The kinds of changes that EFT enables make an EFT-based system fundamentally different from a paper-based system, and therefore consideration must be given to what new, electronic marvel we are creating.
- *Media or communications approach.* EFT is no different from other media that have come on line since the advent of telecommunications. The real revolution occurred when the move from paper media to electronic media began, around the time of

[13] See 'EFT and the public interest', *Telecommunications Policy*, Vol 1, No 3, 1977, pp 258–260.

[14] It is only fair to point out that the history and sociology of technology as subject areas have existed in organized form for some time, and there are respectable organs of communication such as *Technology and Culture*, that document much of the important work in these fields. We see the work we propose joining that stream of effort, and, hopefully, helping to move it forward.

[15] D. Campbell and J. Stanley, *Experimental Quasi-Experimental Designs for Research*, Rand McNally, Chicago, 1966.

[16] A particularly lucid discussion of the haphazard course that development of technology often takes can be found in Donald Schon's book, *Technology and Change: The New Heraclitus*, Delacorte Press, New York, 1967.

[17] ie the primary restrictions on the number of paper presses are flexible (capital, people who wish to work in the press, market for the printed word) while there are major physical restrictions on the number of television or radio stations that can be operated within a given area, such as lack of available broadcasting frequencies. These restrictions alone make the broadcasting media somewhat different from printed media.

[18] There may be other definitions; we have not pushed this list to its limits.

the telegraph. What we are seeing is a growth of a new field of communications channels, and as such our concern should be with the management of communications *per se*, regardless of what is communicated. The telephone did not put first-class mail out of business – EFT will be only an addition, to be managed by communications specialists.

- *Bigger systems approach.* EFT is a provocative development, but it is only a cog in the much larger and more important phenomenon of systemization now underway in our society. Homes, cities, regions, states, country, and even nations are being increasingly interconnected through systems for communication, transportation, and economic exchange. The issues we really address with EFT are based in this larger 'systems world' we are creating.

The selection of definition is central to the process of public policy formation for a new technology because definition simultaneously sets the boundaries of the issue and articulates the major concerns to be discussed. Depending on what definition is selected, parties may be included or excluded from the decision making processes. Definition sets the stage for what aspects will be decided upon and what left 'open'. Most important, early definitions often cast a mould for future decisions that is nearly impossible to break.[19]

The proposed study would examine the interplay of the various institutions in EFT – the institutions that supply the components, provide the service, market the product, and control the industry. The definitions of EFT within each of these institutional sectors differ, and within each sector there are differences in objectives for EFT. Thus, the interests of these institutions in EFT vary. The resolution of such differences will not evolve from a rational exploration and selection among alternatives any more than inventions are invented deliberately by inventors according to a rational, sequential plan. Instead, complex interplay of interests and objectives will take place, eventually leading to a series of compromises which in turn collectively provide the foundation for the EFT system or systems. These foundations will significantly affect the kinds of public policy issues arising from EFT in the future.[20]

EFT is the only new technological development that involves such a wide array of interests and concerns. Future developments in technological systems will probably be at least as complex and difficult to manage institutionally as EFT, so a study of the institutional interactions surrounding EFT will be a great help in understanding the roles that institutions play and how they play them as technologies are developed and deployed. The major questions to answer in this study of institutions are whose interests are served by the various definitions of and approaches to dealing with the technology, and which means institutions use to realize their objectives against the objectives of rival institutions.

Assimilation of new technology by various publics

There have been a few documentary histories of the development and public use of technologies, and there has even been a fairly detailed case study of EFT in a public setting (Syracuse study) that attempts to shed light on how the technology is assimilated.

The difficulties with these approaches are obvious: historical

[19] It is unlikely, for example, that a proposal to take half of the television airwaves out of private use would be allowed to progress very far today.

[20] We feel that in a way the NCEFT has already taken a stand on a definition for EFT in this context. Our reading of the Commission's work thus far places it somewhere between the 'payments system' approach and the 'financial system' approach on our list. They recommend, in the end, that EFT be considered a new way of handling payments transactions that *may* expand into other financial areas as well. The development of EFT should be left to private activity, and competition should be encouraged. The only major deviation from the payments system or financial system definition is their concern about the possible privacy impacts that EFT might have.

studies do not have systematic data collected over a period of time to document the nuances of the public's assimilation of a technology; and the narrow, short-term studies cannot accumulate data over a long enough period or in a sufficiently representative sample to portray adequately the actual process of assimilation. Moreover, such studies usually do not account for the fact that systems like EFT affect different 'publics' in different ways.[21]

The proposed study would establish a sequence of steps to measure the attitude of various publics towards understanding of, use of, and satisfaction with EFT over a fairly long period. The study would begin as soon as possible, and continue until a certain pre-established level of EFT use had been reached. Measures would be taken using representative samples of each public in a panel study format, perhaps on a semi-annual basis. Using these panel data, a profile of assimilation of EFT could be constructed. This profile could be used to correlate shifts in acceptance or demand for EFT with changes in the technology or the controls on the technology. Also, this study would be useful in exploring hypotheses concerning the adoption of innovation by different publics.

Expected and actual impacts of new technology

Impacts of new technologies are important subjects of study not only because an understanding of impacts is necessary in dealing with the problems technologies bring, but also because actual impacts may or may not conform to expectations about the effects of the technologies. There have been only a few systematic studies of the impacts of new technologies on social, political and personal behaviour, in addition to industry and economy, and most of these have been *ad hoc* studies carried out some time after the technology is in use. These studies have limited effect on public policy because they do not provide a comprehensive picture of the processes by which the impacts emerge, nor do they provide a systematic check on the accuracy of predictions.

The proposed study would comprise two major parts. First, there would be construction of a set of alternative scenarios of impacts within a general framework of EFT as permitted by regulation and other constraints. These scenarios might draw from the definitions mentioned above. Each scenario would trace the development of EFT according to its perspective, and predict its likely impacts. The collection of these scenarios would provide the hypotheses with which the actual experience of EFT would be compared.

The second part of the study would entail actual measurements of the impacts along at least three major dimensions. These would be: impacts on mechanisms of exchange, including modes of exchange and speed, volume, and size of transactions; impacts on those aspects of consumer and institutional behaviour directly related to exchanges supposedly facilitated by EFT, including changes in preferences for different exchange media, expenditure habits, and use of credit; and impacts on fiscal and monetary activities at various levels, including effects on cash reserves, float, consumer credit, and interest rates.

These measures of impacts could be gathered by several means: from surveys of consumer attitudes; from unobtrusive observation; from analysis of transactions on a sample of retail or business establishments; and from analysis of regular financial and economic statistics collected by government and private agencies. Together, the

[21] There may be great differences in EFT impacts among rich v poor people, urban v rural people, and those who buy with cash v those who use mainly credit.

measures of actual and hypothesized impacts would provide policy makers with an indication of the extent to which the scenario under which EFT policy was originally constructed was being borne out in reality.

Synergistic impacts of new technology

Technological change is both driven by and in turn drives other facets of human existence. As more advanced technology becomes a central part of human existence, and as larger portions of peoples' lives are enmeshed in dealing with technology, it becomes clear that new technologies merge with existing technologies to produce impacts and opportunities beyond the new technology itself.

The synergism of technology presents both opportunities and problems, often in mixes that are unforeseen.[22] In EFT it is the synergistic capability generated by the merging of the digital computer and advancements in telecommunications that provides the basic framework for a workable system, and simultaneously introduces the problems concerning EFT that are discussed in articles on privacy, consumer issues, competition impacts, and so on. We are anticipating these possible impacts in advance, but we do not yet know what the full synergistic impacts of EFT will be, nor can we know until they appear. By an ongoing study of the introduction, development, and use of EFT it will be possible to document the ways in which EFT technology becomes attached to other technologies, and, in turn, brings new capabilities and/or problems.

This documentary work would be done in much the same way as other documentary tests. One or more observers could use various methods of collecting information (interviews, surveys, content analysis of news, reports of agencies and institutions, etc) to map the course by which various EFT technological elements come together and interrelate. Also, they would document the ways in which EFT-related technologies merge with other technologies to produce new meta-technologies. The documentary evidence would be used to inform public policy makers of the secondary impacts of EFT, thus providing an account of issues that might require policy action.

Processes of change in new technologies

Almost every technology, once introduced, begins a process of change that continues until it is rendered obsolete, is abandoned, or mutates into what can be regarded as something new. This process of change is usually regarded as progress, since most such changes are initiated by the efforts of people trying to improve a particular technology so that it does its job more quickly, efficiently, and/or with results of higher quality. Major changes can bring other impacts too, however, so most new technologies bring a continuing chain of impacts.

The proposed study would examine over time the changes in EFT technology. The methods would be to examine the stream of changes a technology can undergo, the mechanisms by which those changes are introduced and effected, and the resulting changes in the impacts of the technology brought about by this continuing evolution.

Implementation mechanisms for proposed study

Two issues must be resolved before such a longitudinal case study of

[22] The most obvious examples of the two-edged sword of synergism in technological developments are in the field of weaponry. New developments are linked with existing knowledge to produce weapons that are superior because they have much greater 'kill power' than other weapons. These weapons are therefore a deterrent to attack (or provide for a better offence), but because they can cause great destruction even when controlled by only a few people, there is also an increased possibility of the use of these weapons by 'uncontrolled' factions, ie those without a country and therefore without recognized negotiating rights. It is much easier to blackmail or demand huge concessions when one is armed with an atom bomb than when one has only a TNT bomb.

EFT can be undertaken. First, the overall structure of the study must be established. One approach would be to centralize study in the efforts of a single study group that would conduct each of the six studies outlined above and integrate the findings into a running account of EFT research. The advantages of this approach would be the high degree of coordination and control possible with a centralized arrangement, and the likelihood that the results of all the studies could be brought together effectively. The disadvantage would be the possibility of 'narrowness' or restricted vision in such a study: in other words, it might become in-bred and lose a sense of diversity and perspective.

The other major approach would be to establish a central coordinating group that would be a repository and clearinghouse for information on EFT research performed by itself and others. This centre would integrate the findings of all studies of EFT into an ongoing record, and could conduct research on topics itself. The advantage of this approach would be diversity of opinion and thought in EFT research, guaranteed by the involvement of many researchers. The disadvantage would be the costs and problems involved in trying to coordinate the results of separate enterprises.[23]

The second issue to be resolved is that of the duration of the longitudinal study. This is difficult to determine, since it is impossible to predict exactly what will happen with EFT, and when. Some believe that major EFT components will be operating by 1979. Others believe that its evolution has already faded, and that EFT may not happen for a long time, if at all. To meet this difficulty, it may be necessary to develop new flexibility in research efforts and support. It may be that the best solution would be some mix of institutional and project support. The idea would be to establish a continuing coordinating study in an existing research institution with a relatively low level of support. This would enable consistent work and continued study, at a slow pace when appropriate and at a more rapid pace as EFT activities increase.

[23] It might also be noted that the independent research model fits more closely with the current trends in US federal research support, while the practice of continued, large-scale institutional support for research is less common and more difficult to establish.